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On Developing Transversal Competences of Modern Engineers for Coal Mining Emerging

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Abstract. Currently, coal mining as well as practically all leading industries requires such management specialists who are able to solve new tasks in complex and constantly changing conditions. The paper highlights the ways to contribute to the formation of future specialists' competencies to satisfy the demands of present-day labour market. The paper aims to uncover some underpinning competences of coal-mining engineers in addition to technical skills presented as a Top Ten Transversal Competences' Checklist for Coalminers (TTTCCC). This paper takes the form of a discussion relating to the needs and requirements of English language education of a modern coal-mining engineer in Russia. Some examples of low efficiency in university English for Specific Purposes (ESP) teaching bring to a number of possible solutions in and outside the mining university language classrooms.

1 Introduction

Mining engineering is one of the largest spheres of human activity, its nature is "increasingly globalized" [1]. It includes a range of professional fields and disciplines, each of which works around the world for the benefit of humanity, scientific and technological progress. As a branch, coal mining engineering deals with the identification, extraction, production and processing of one of the most valuable earth elements, the world's major sources of energy.

Far from being in decline, coal has been growing rapidly as one of the world's most used resources. According to The World Atlas's data of 2019, China, the USA, India, Australia, Indonesia, Russia, South Africa, Kazakhstan, Colombia, and Ukraine make the top ten in coal production and are leading the way [2]. Each country needs qualified labour force and the system of professional education is not only to meet the requirements of the present day

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but also to take into account the prospects for the development of new markets and technologies.

Today, the quality of education is undoubtedly a strategically important factor in the country's further social and economic development, a condition for ensuring its national security, on the one hand, and a means of social protection, a guarantee of stability, and professional self-realization of the person at different stages of life, on the other [3].

Professional standards, which are widely used in world practice and being adopted in Russia now, contain detailed description of regulating labour relations, regulatory framework, and what is very important - the characteristics of the jobs (a complex combination of modern requirements for knowledge, cultural and professional skills, and work experience).

Some commentators argue that modern engineering education sits at the intersection of diverse, complex and sometimes competing voices about the general need for more engineers and what skills those engineers should possess. Many are calling for the education of holistic engineers in order to address complex social issues being faced today [4]. At the same time, some experts take up the position that today specifically four-year bachelor engineering education systems are almost stagnant with memorable, traditional, imitative, repetitive and unquestionable information transmissions without interactive debate and criticism [5]. The lack of connection between the abilities of new graduated engineers and those abilities really claimed by companies is noted [6].

2 Materials and Methods

New trends in economic and social development of mining regions and the impact of globalisation have contributed to the changes in perception of vocational learning and specialist skills required by contemporary workplaces. The problem of forming the competence of future specialists has become more urgent, since in modern society the need for professionals with a high level of development of creative potential, the willingness to actively and quickly engage in a variety of activities, the ability to analyze, systematically set and solve various tasks, to overcome conflicts and contradictions, etc. is clearly expressed. Such competencies represent skills, which are increasingly referred to as 21st century, or wider skills. This broadly indicates that the modern workforce needs increased knowledge, capability for decision-making and dealing with the non-routine skills to address many unexpected situations and challenges they will encounter in the real world [7]. Moreover, in modern conditions, the obsolescence of technology occurs on average, every 2-3 years. The volume of knowledge in the field of science, culture, production is increasing two to three times faster than 5-7 years ago. Therefore, the knowledge obtained by the student during the first years of study at the University, becomes irrelevant for the young specialist, if he has not formed the ability to learn and actively transform themselves and the world. This fundamentally changes the view of the process of training future specialists in higher education.

The scientific and technological revolution is not limited to scientific and technological progress. It is known that its significant impact is manifested in the change of the spiritual sphere, in the consumption of material and spiritual values by society, in the qualitative transformations of all production and ideological institutions, in the development of priority areas of scientific, technical and socio-political knowledge, and in the change of the role and place of man in the modern world. Therefore, it is necessary that the process of training a new type of specialist be organically linked to the development of the general culture of the individual. The workplace as a context for facilitating individual learning provides affordances that may contribute to employee learning opportunities embedded in day-to-day activities [8]. In addition, the formation of new value orientations should be carried out in

accordance with the individual characteristics of the individual on the basis of improving psychological and pedagogical activity in the process of vocational education.

The fundamental academic disciplines of coal mining engineering study traditionally include Mathematics, Geosciences, Geochemistry, Geophysics, Mineralogy, Mechanics, Thermodynamics, Surface Mining, Open-pit mining, Underground mining, Drilling and blasting, etc. On the other hand, it has been recognized in academia and industry alike that engineers require an ever-broadening skill set in order to function competitively [9]. Considering the ever-growing scale and role of leading players in the world market, understanding of diverse working environments, national cultures and strong cross-cultural communication skills will prove invaluable [10].

To successfully adapt to today's changes and to lead meaningful and productive lives young professionals also need some transversal skills to be developed during their study, which are defined by UNESCO's TVETipedia Glossary as "typically considered as not specifically related to a particular job, task, academic discipline or area of knowledge and that can be used in a wide variety of situations and work settings " [11]. The contemporary requirements of work and learning, place new demands on skills development. Engaging in learning and applying skills not only within but also across a variety of learning and working contexts enables employees to develop a range of transferrable or transversal skills required by the contemporary economy and knowledge society [12]. What is more, the interplay between the context of education and work requires employees to develop a range of transferable skills that would enable them to adapt to the changing nature of the learning space at work. The debate on work-related competences has highlighted the issue of the significance of developing personal competences and abilities that people can use in a variety of settings, including workplace settings [13; 14]. According to the concepts of the European Higher Education Area (EHEA), acquiring specific and transversal competences is considered necessary at the end of the university degree and thus a competence-based educational system is to be implemented in higher educational institutions. The list of transversal skills/ competences required in the 21st century's labour market is long, and for the job of a coal-mining engineer, it can be presented as a Top Ten Transversal Competences' Checklist for Coalminers (TTTCCC):

1. Problem-solving and analytical skills referring to the ability to regulate difficult or unexpected situations in the workplace as well as complex business challenges.
2. Confidence related to a certainty about handling daily struggle.
3. Efficiency as a specific application of effort to produce a specific outcome with a minimum amount or quantity of waste, expense, or unnecessary effort.
4. Strategically and innovative thinking which involves generation and application of unique business insights and opportunities for creating competitive advantage in the market.
5. Flexibility as the ability to incorporating changes on certain this feedback into your teaching. In addition, on-the-spot changes situations and adaptability the ability to adapt to change. Totaled up, flexibility and adaptability relate to being able to acclimate yourself to changing roles, job responsibilities, and schedules.
6. Strong technical/ IT skills as the ability to work in a fast-paced and collaborative, cross-discipline team environment, and a passion for digital entertainment.
7. Interpersonal skills refer to the ability to communicate, cooperate, connect, relate, and work with others.
8. Information processing skills represent preparing the data for carrying out the risk analysis and for identifying the necessary, reliable, relevant and useful information in order to achieve the objectives.
9. Reflective thinking is a part of the critical thinking process referring specifically to the processes of analyzing and making judgments about what has happened.

10. Foreign language skills have been traditionally considered as the ability to speak, listen, read and write in a foreign language. It has also come to include a fifth skill, culture.

Such kinds of skills allow developing a corporate culture, social freedom, attitude to the chosen profession in the new generation of specialists. The analysis of the current situation leads to the need for changes in the technology of training, implemented in the field of education, and changes in the perception of the educational system. However, teaching these skills might be challenging within the traditional university classroom.

In the TTTCCC, language is absolutely central to the international career, or as a minimum, to the global vision of the engineer: without it, a professional cannot make sense or communicate in their domain. To give one example, one of the largest Russian coal companies "Northern Kuzbass", with more than 3,000 employees, performs as a part of the multinational coal mining and metallurgical corporation "ArcelorMittal S.A.", headquartered in Luxembourg City. The language of business channels - teleconferences, selectors and all business correspondence here is English. The English language has become the dominant means of international communication. Its non-native speakers like the Russians, etc., now far outnumber the conventional native speakers. Importantly, for a present-day broad-minded mining engineer it is required in order to:

• communicate the needs in the international context and work productively worldwide,
• understand and make the most effective use of the world recent advances,
• use new knowledge and produce new specialized knowledge relevant to the knowledge economy,
• be well-connected in the massive presence of ICT in every sphere of high-tech solutions, where English dominates as lingua franca, a language of communication without necessarily being a language of identification.

3 Results and Discussion

The peculiarity of the discipline "Foreign Language" is that communication in a foreign language is both a goal and a means of training. Communication in a foreign language (as the purpose of training) provides many opportunities for the teacher to form students' knowledge, skills and abilities that re-grow into the necessary professional competence of the specialist. However, within discussions of professional language education, here comes a problem of the teacher inadequate efficiency in specific fields known as out-of-field teaching. It is common knowledge that teacher specializations "provide a sense of identity, and help to organize teachers around common commitments and expertise" [15: 3] On the other hand, the phenomenon of out-of-field teaching, when teachers are assigned to teach disciplines for which they have little training and qualification, has been long a crucial but relatively unrecognized problem in education [16]. University teachers focus on the language skills, but have little background in mining engineering. The problem has been discussed and commented upon mainly locally (e.g., at the *Competitiveness of University Graduates: Challenges of the Time* Round Table, held in 2018 in the Siberian State Industrial University, Novokuznetsk) [17], and has not become a major concern in the realm of national educational policy in Russia.

It cannot be denied though that many professional associations of teachers of English (TESOL, IATEFL) have ESP - English for Specific Purposes – sections, and that most universities in Russia and in the world have had ESP in their curricula, which refers to teaching the English language to university students or people already in employment, with reference to the particular vocabulary and skills they need, including transversal skills. Much attention is devoted to ESP course design and developing textbooks. Given courses focus on one occupation or profession, such as technical English for coal mining engineers. One of such textbooks – *English for Miners* (2010) was successfully written and introduced on the

national scale by the tandem of authors: Dr. Prof. Lyudmila Grafova, the linguist, and Dr.V. Babichev, the former mining engineer, both from the National University of Science and Technology "MISiS", Moscow. Admittedly, in spite of uniqueness and epy solid track record of the book, these products get old quickly, and the content (knowledge) cannot avoid lagging behind in today's fast-paced world.

Educational changes might be successfully implemented on different levels, including modest-sized university scale. In the classroom:

1. New approaches such as *Content and Language Integrated Learning - CLIL* (created in 1994 by D. Marsh) are widely put to the test and accepted as effective innovations. CLIL, for one, has been identified as very important by the European Commission because: "it can provide effective opportunities to use their new language skills now, rather than learn them now for later use" [18].
2. Another popular methodology - *Discursive lecturing & Question-driven instruction (QDI)* was introduced by Ian D. Beatty, et al., USA [19]. It combines the student's active learning with what they called agile teaching and requires live up-to-date knowledge and skills from the teacher [20].
3. LTS approach - Learning Through Service – is another option for engineering students.

The educational goals of LTS are to develop those who use a diversity of skills, technical and professional, to work across disciplinary and cultural divides to solve complex problems.

For students, LTS provides a space where they find a form of engineering that marries their desire to help others and passion for engineering, despite being simultaneously embedded in the narrowness of decontextualized technical courses. Moreover, LTS contributes to the solution for the problem of modeling secondary language environment and facilitates language acquisition [21].

Many project-based activities through international student clubs such as Engineers Without Borders (http://ewb-international.com/about-ewb-i/), Engineers for a Sustainable World (https://www.eswglobal.org), and Bridges to Prosperity (https://bridgestoprosperity.org) are well-supported under LTS umbrella. They can be domestic or international and they tend to include some form of travel to the project site for the student team. Though not tied to a specific course, many of these programmes are still rooted in learning objectives and are seen as important elements of the bigger picture of educating engineering students, as well as a valuable learning resource. Outside the classroom:

1. Participation in a foreign study programmes which facilitates foreign study experiences and can teach students valuable skills (TTTCCC) outside their technical skill set.
2. For online learning, on FluentU Business English Blog, there are Free and Affordable Online Courses for Excellent Engineering English, focusing on smart study tips for engineering English.
3. For e-learning, A MOOC (Massive Open Online Course) lets students take courses from prestigious universities and expert teachers, all from a laptop. Most MOOCs are affordable or even free, and can find be found on practically any subject, and can develop transversal skills in addition to the major courses.

4 Conclusion

Professional development involves changes, which shall not just be subject to compulsory implementation as a component of the educational reform, but might go effectively and smoothly as a small-scale initiative and innovation. The problem of educating a modern coal-mining engineer encompasses a wide range of aspects, including both major professional competences and transversal skills that should not be underestimated. Given that, the field is complex and interdisciplinary thus laying out direction for future research and innovation.

This subscription to the development of one segment of professional education might be viewed as a commitment to a challenge and request for discussion.

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